What is claimed is:

1. A magnetic recording medium having a nonmagnetic substrate on which is provided at least a softly magnetic under-film, an orientation control film that controls an orientation of a film directly above, a perpendicular magnetic recording film having an axis of easy magnetization oriented to be mainly perpendicular to the substrate, and a protective film, wherein the orientation control film has a material composition forming a $C11_b$ structure.

2. The magnetic recording medium according to claim 1, wherein it is desirable that the orientation control film should include one, two or more selected from at least Al, Ag, Au, Cu, Ge, Hf, Ni, Si, Ti, Zn and Zr.

3. The magnetic recording medium according to claim 1, wherein it is desirable that the orientation control film be CuHf, CuTi, or CuZr alloy.

4. The magnetic recording medium according to claim 2, wherein it is desirable that the orientation control film be CuHf, CuTi, or CuZr alloy.

5. The magnetic recording medium according to claim 1, wherein it is desirable that the orientation control film be GeW or GeMo alloy.

6. The magnetic recording medium according to claim 2, wherein it is desirable that the orientation control film be GeW or GeMo alloy.

7. The magnetic recording medium according to claim 1, wherein it is desirable that the orientation control film be SiMo, SiW, or SiRe alloy.

8. The magnetic recording medium according to claim 2, wherein it is desirable that the orientation control film be SiMo, SiW, or SiRe alloy.

9. The magnetic recording medium according to claim 1, wherein it is desirable that the orientation control film be ZnHf or ZnTi alloy.

10. The magnetic recording medium according to claim 2, wherein it is desirable that the orientation control film be ZnHf or ZnTi alloy.

11. The magnetic recording medium according to claim 1, wherein it is desirable that the orientation control film be NiTa alloy.

12. The magnetic recording medium according to claim 2, wherein it is desirable that the orientation control film be NiTa alloy.

13. The magnetic recording medium according to claim 1, wherein it is desirable that the orientation control film should have a thickness of not less than 0.5 nm and not more than 20 nm.

14. The magnetic recording medium according to claim 2, wherein it is desirable that the orientation control film should have a thickness of not less than 0.5 nm and not more than 20 nm.

15. The magnetic recording medium according to claim 1, wherein it is desirable that the perpendicular magnetic recording film be formed of a material that includes at least Cr and Pt.

16. The magnetic recording medium according to claim 2, wherein it is desirable that the perpendicular magnetic recording film be formed of a material that includes at least Cr and Pt.

17. A method of manufacturing the magnetic recording medium according to claim 1, comprising carrying out, in order, at least a step of forming a softly magnetic under-film on a nonmagnetic substrate, a step

of forming an orientation control film that controls an orientation of a film directly above, a step of forming a perpendicular magnetic recording film having an axis of easy magnetization oriented to be mainly perpendicular to the substrate, and a step of forming a protective film.

18. A method of manufacturing the magnetic recording medium according to claim 2, comprising carrying out, in order, at least a step of forming a softly magnetic under-film on a nonmagnetic substrate, a step of forming an orientation control film that controls an orientation of a film directly above, a step of forming a perpendicular magnetic recording film having an axis of easy magnetization oriented to be mainly perpendicular to the substrate, and a step of forming a protective film.

19. A magnetic recording and reproduction apparatus comprising the magnetic recording media according to claim 1 and a magnetic head that records and reproduces information on the magnetic recording medium, wherein the magnetic head is a magnetic monopole head.

20. A magnetic recording and reproduction apparatus comprising the magnetic recording media according to claim 2 and a magnetic head that records and reproduces information on the magnetic recording medium, wherein the magnetic head is a magnetic monopole head.